Microwaving the Moon: Water Extraction from Icy Regolith

Other

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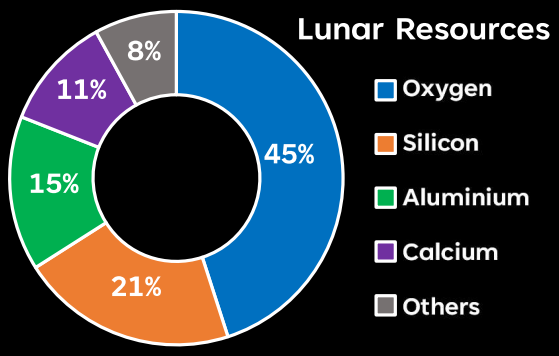
The Open University

1. In-Situ Resource Utilisation (ISRU)

→ ISRU is the process of using resources available at a mission site to resupply a mission.

→ The Moon contains many resources that could be used to supply missions such as a permanently crewed base or an extended missions to Mars.

→ These resources can be used to create rocket fuel, solar panels, breathable atmospheres, habitats and further construction materials.

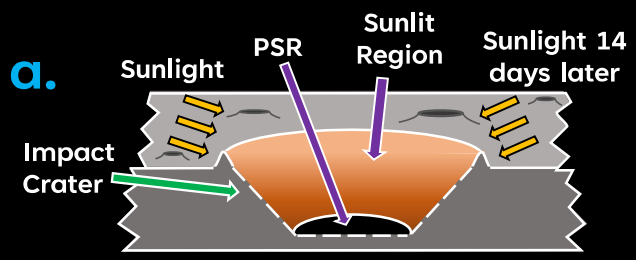


2. Lunar Water

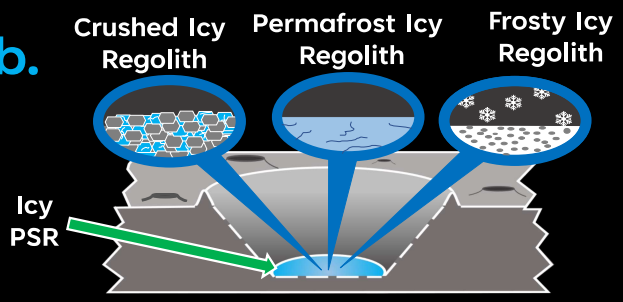
→ **The Moon contains water ice at the poles.**
- Experiments confirm at least 5 % of the regolith is ice.
- However, it could be as high as 30 %.

→ **Water ice is trapped in Permanently Shadowed Regions (PSRs) at the poles.**
- PSRs never see any direct sunlight.
- Can be as cold as 30 K (-240 °C).
- The majority of PSRs occur at the bottom of impact craters. How PSRs form in these craters is shown in figure a.

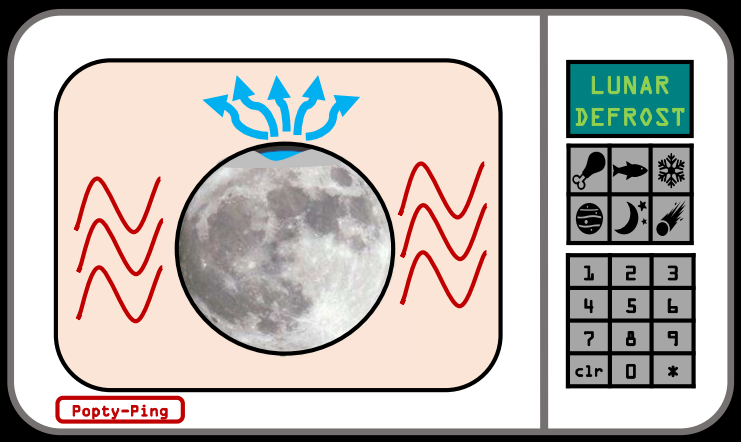
→ **The nature of the ice is not known.**
- It could range from dense solid ice to fluffy frosty ice.
- Potential ice forms are shown in figure b.



A crater that allows a PSR to form. This only occurs at the poles due to the high latitude and the Moon's low obliquity.



The different forms of water ice that could be found in the PSRs at the poles. It is not yet known which of these hypothesised forms are correct.



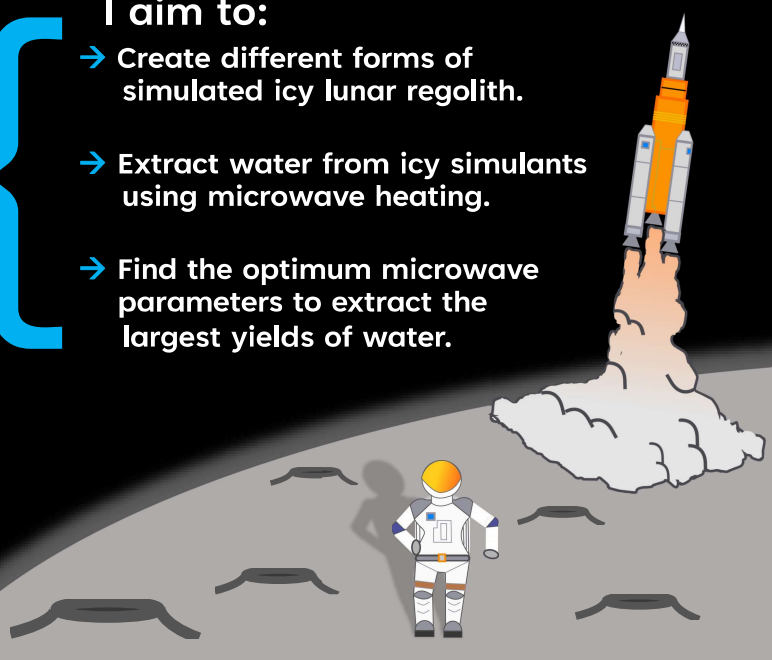
3. My Project

I aim to:

→ Create different forms of simulated icy lunar regolith.

→ Extract water from icy simulants using microwave heating.

→ Find the optimum microwave parameters to extract the largest yields of water.



This work should allow the development of instruments and techniques to extract water to supply future missions on the lunar surface.